ATTACHMENT B

Attachment B: Reference Circuits – Stations Operated in the Amateur Radio Service In Selected Bands

High End 75 M SSB contest station

Competitive contest stations use big antennas in an effort to contact even the smallest and most remote stations.

Characteristics		Values
Frequency Band (MHz) Channel Spacing Information Rate Emission Type(s) Transmitter Power (dBW) Transmission Line Loss (dB) Antenna Polarization Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) Receiver IF Bandwidth Receiver Noise Figure (dB) Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km)	3.75-4.0 Random speech 2K50J3E 31.7 Transmit: .2 Horizontal; Vertical 12 43.5 2500 Hz 13 -135	Receive: 0.2
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3-element yagi--K3ZO and others. Vertical polarization is sometimes preferred for distant contacts, trading off a lower ERP for a more suitable radiation pattern.

Typical 75M SSB contest station

Characteristics		Values
Frequency Band (MHz) Channel Spacing Information Rate Emission Type(s) Transmitter Power (dBW) Transmission Line Loss (dB) Antenna Polarization Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) Receiver IF Bandwidth Receiver Noise Figure (dB) Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km) Full wave horizontal loop at 50 ft.	3.75-4.0 Random speech 2K50J3E 31.7 Transmit: .2 Horizontal; Vertical 8 39.5 2500 Hz 13 -135	Receive: 0.2
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High End 80M CW contest station

Characteristics	Values	
Frequency Band (MHz) Channel Spacing Information Rate Emission Type(s) Transmitter Power (dBW) Transmission Line Loss (dB) Antenna Polarization Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) Receiver IF Bandwidth Receiver Noise Figure (dB) Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB) Maximum Path Lenoth (km)	3.5-3.75 Random 10 bit/sec 100HA1A 31.7 Transmit: .2 Horizontal; Vertical 12 43.5 CW:100 Hz 13 -149	Receive: 0.2
,		

Typical 75 M SSB Amateur Station

The typical SSB amateur station communicates with other SSB using F layer propagation.

Characteristics Values

Frequency Band (MHz) 3.75-4.0
Channel Spacing Random
Information Rate Speech
Emission Type(s) 2K50J3E
Transmitter Power (dBW) 31.7

Transmission Line Loss (dB)

Transmit: .2 Receive: 0.2

Antenna Polarization Horizontal; Vertical Antenna Maximum Gain (dBi) 7
Maximum e.i.r.p. (dBW) 38.5
Receiver IF Bandwidth SSB:2500 Hz
Receiver Noise Figure (dB) 13
Possition System Noise (dBM) 135

Receiver System Noise (dBW) -135
Receiver Signal-to-Noise Ratio (dB) +6

Maximum Path Length (km) Depends on propagation mode

Dipole at 40 ft

Typical 80M CW Amateur Station

Characteristics Values

Frequency Band (MHz) 3.5-3.75
Channel Spacing Random
Information Rate 10 bit/s
Emission Type(s) 100HA1A
Transmitter Power (dBW) 20

Transmission Line Loss (dB)

Transmit: .2

Receive: 0.2

Antenna Polarization Horizontal; Vertical

Antenna Maximum Gain (dBi)

7

Maximum e.i.r.p. (dBW)

Receiver IF Bandwidth

Receiver Noise Figure (dB)

Receiver System Noise (dBW)

Receiver Signal-to-Noise Ratio (dB)

7

13

13

149

149

Maximum Path Length (km) Depends on propgation mode

Dipole at 40 ft

High End 80 M Digital Amateur Station

Characteristics Values

Frequency Band (MHz)
Channel Spacing
Information Rate
Emission Type(s)

3.5-3.75
Random
45-300 bit/sec
Many different types

Transmitter Power (dBW) 31.7

Transmission Line Loss (dB)

Transmit: .2

Antenna Polarization

Receive: .2

Horizontal; Vertical

 Antenna Maximum Gain (dBi)
 8

 Maximum e.i.r.p. (dBW)
 39.5

 Receiver IF Bandwidth
 500

 Receiver Noise Figure (dB)
 13

 Receiver System Noise (dBW)
 -142

 Receiver Signal-to-Noise Ratio (dB)
 +3

Maximum Path Length (km) Depends on the propagation mode

Typical 80M Digital Amateur Station

Characteristics

Values

Frequency Band (MHz)	3.5-3.75
Channel Spacing	Random

Information Rate 45-300 bit/sec, 0-300 bit/sec worst case

Emission Type(s) Many different types 17

Transmitter Power (dBW)

Transmission Line Loss (dB) Transmit: .2 Receive: .2

Antenna Polarization Horizontal; Vertical Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW) 23.8 Receiver IF Bandwidth 500 Hz Receiver Noise Figure (dB) 13 Receiver System Noise (dBW) -142 Receiver Signal-to-Noise Ratio (dB) +3

Maximum Path Length (km) Depends on propagation mode

Typical 80 M SSTV Amateur Station

The typical SSTV amateur station exchanges pictures with other stations.

Characteristics Values

Frequency Band (MHz) 3.75-4.0 Channel Spacing Random

Information Rate .22 to 7.5 frames/sec

Emission Type(s) 2K50J3E Transmitter Power (dBW)

Transmit: .2 Transmission Line Loss (dB) Receive: 2

Antenna Polarization Horizontal; Vertical

Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) 41.4 Receiver IF Bandwidth 2500 Receiver Noise Figure (dB) 13 Receiver System Noise (dBW) -145 Receiver Signal-to-Noise Ratio (dB) +30

Maximum Path Length (km) Depends on propagation mode

Typical 80 M Beacon Amateur Station

N/A--There don't appear to be any in operation.

Typical 80 M Hand-Held Amateur Station

The typical SSB hand-held amateur station can communicate with some other SSB voice amateur stations.

Values Characteristics

3.75-4.0 Frequency Band (MHz) **Channel Spacing** Random speech Information Rate 2K50J3E Emission Type(s) Transmitter Power (dBW)

Transmit: .0 Receive: 00

Transmission Line Loss (dB) Vertical Antenna Polarization -20 Antenna Maximum Gain (dBi) -17 Maximum e.i.r.p. (dBW) 2500 Hz Receiver IF Bandwidth Receiver Noise Figure (dB) 13 Receiver System Noise (dBW) -135 Receiver Signal-to-Noise Ratio (dB) +6 Maximum Path Length (km)

Mizuho sell these little radios.

Typical 80M AM station Characteristics

Frequency Band (MHz) Channel Spacing Information Rate 3.75-4.0 Random Speech 6K0A3E Emission Type(s)
Transmitter Power (dBW) 31.7 Transmit: .2 Transmission Line Loss (dB) Horizontal

Transmission Line Loss (dB)
Antenna Polarization
Antenna Maximum Gain (dBi)
Maximum e.i.r.p. (dBW)
Receiver IF Bandwidth
Receiver Noise Figure (dB)
Receiver System Noise (dBW)
Receiver Signal-to-Noise Ratio (dB)
Maximum Path Length (km) 39.5 6 kHz 13 -132 10

Depends on propagation mode

Values

Receive: 0.2

High End 20 M SSB contest station

Competitive contest stations use big antennas in an effort to contact even the smallest and most remote stations.

Characteristics Values

Frequency Band (MHz)

Channel Spacing

Information Rate

Emission Type(s)

Transmiter Power (dBW)

Transmission Line Loss (dB)

Transmit: .4

Receive: 0.4

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 17
Maximum e.i.r.p. (dBW) 48.3
Receiver IF Bandwidth 2500 Hz
Receiver Noise Figure (dB) 13

Receiver System Noise (dBW) -149 (29000 Kelvin background)

Receiver Signal-to-Noise Ratio (dB) +6

Maximum Path Length (km)

Stacked yagis in the Antenna book feed with 200 ft of Hardline in a quiet rural location.

Typical 20M SSB contest station

Characteristics Values

Receive: 0.6

Frequency Band (MHz)

Channel Spacing

Information Rate

Emission Type(s)

Transmitter Power (dBW)

Transmission Line Loss (dB)

Antenna Polarization

14.15-14.35

Random

speech

2K50J3E

31.7

Transmission Line Loss (dB)

Antenna Polarization

14.15-14.35

Random

speech

2K50J3E

Transmit: .6

Horizontal

Maximum Path Length (km)

Single 4 element yagi in a typical suburban location. Height primarily affects the vertical pattern but not the maximum gain.

High End 20M CW contest station

_	Characteristics	Values

Frequency Band (MHz) 14.0-14.100
Channel Spacing Random
Information Rate 10 bit/sec
Emission Type(s) 100HA1A
Transmitter Power (dBW) 31.7

Transmission Line Loss (dB)

Transmit: 4

Receive: 0.4

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 17
Maximum e.i.r.p. (dBW) 48.3
Receiver IF Bandwidth CW:100 Hz
Receiver Noise Figure (dB) 13
Receiver System Noise (dBW) -149
Receiver Signal-to-Noise Ratio (dB) +6
Maximum Path Length (km)

Typical 20 M SSB Amateur Station

The typical SSB amateur station communicates with other SSB using F layer propagation.

Characteristics Values

Frequency Band (MHz)

Channel Spacing

Information Rate

Emission Type(s)

Transmitter Power (dBW)

Transmission Line Loss (dB)

14.15-14.35

Random

Speech

2K50J3E

31.7

Transmission Line Loss (dB)

Transmit: .6

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 12
Maximum e.i.r.p. (dBW) 43.1

Receiver IF Bandwidth SSB:2500 Hz
Receiver Noise Figure (dB) 13

Receiver Noise Figure (dB) 13
Receiver System Noise (dBW) -145
Receiver Signal-to-Noise Ratio (dB) +6

Maximum Path Length (km) Depends on propagation mode

Legal limit amp and a small tribander like the Force 12 C3 (12' boom). Tribander has 4.5 dB gain over a dipole.

Receive: 0.6

Values

Typical 20M CW Amateur Station

Characteristics

Frequency Band (MHz)

Channel Spacing

Information Rate

Emission Type(s)

Transmitter Power (dBW)

14.0-14.1

Random
10 bit/s
100HA1A
20

Transmission Line Loss (dB)

Transmit: .5

Receive: 0.5

Antenna Polarization

Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW)

Receiver IF Bandwidth

Receiver Noise Figure (dB)

Receiver System Noise (dBW)

Receiver Signal-to-Noise Ratio (dB)

Thorizontal

Horizontal

CW:100Hz

13

Receiver System Noise (dBW)

-159

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) Depends on propgation mode

High End 20 M Digital Amateur Station

Characteristics Values

Frequency Band (MHz)

Channel Spacing

Information Rate

Emission Type(s)

Transmitter Power (dBW)

14.0-14.1

Random

45-300 bit/sec

Many different types

31.7

Transmitter Power (dBW) 31.7
Transmission Line Loss (dB) Transmit: .4 Receive: .4

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 17
Maximum e.i.r.p. (dBW) 48.3
Receiver IF Bandwidth 500
Receiver Noise Figure (dB) 13
Receiver System Noise (dBW) -152
Receiver Signal-to-Noise Ratio (dB) +3

Maximum Path Length (km) Depends on the propagation mode

Typical 20M Digital Amateur Station Characteristics

Values

Frequency Band (MHz) Channel Spacing Information Rate Emission Type(s) Transmitter Power (dBW)	14.0-14.1 Random 45-300 bit/sec, 0-30 Many different type 17	00 bit/sec worst case s
Transmission Line Loss (dB) Antenna Polarization Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) Receiver IF Bandwidth Receiver Noise Figure (dB) Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km)	Transmit: .6 Horizontal 8 24.4 500 Hz 13 -152 +3 Depends on propag	Receive: .6

Typical 20 M SSTV Amateur Station

The typical SSTV amateur station exchanges pictures with other stations.

Characteristics Values

Frequency Band (MHz) Channel Spacing Information Rate Emission Type(s) Transmitter Power (dBW)	14.15-14.35 Random .22 to 7.5 frames/sec 2K50J3E 30	
Transmission Line Loss (dB)	Transmit: .6 Receive: .6 Horizontal	
Antenna Polarization Antenna Maximum Gain (dBi)	12	
Maximum e.i.r.p. (dBW) Receiver IF Bandwidth	41.4 2500	
Receiver Noise Figure (dB) Receiver System Noise (dBW)	13 -145	
Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km)	+30 Depends on propagation mode	

Typical 20 M Beacon Amateur Station Characteristics

Values

Frequency Band (MHz)	14.1
Channel Spacing	N/A
Information Rate	10 bit/s
Emission Type(s)	50HA1A
	20
Transmitter Power (dBW)	Transmit:.5
Transmission Line Loss (dB)	Vertical
Antenna Polarization	
Antenna Maximum Gain (dBi)	0
Maximum e.i.r.p. (dBW)	19.5
Receiver IF Bandwidth	100 Hz
Receiver Noise Figure (dB)	13
Receiver System Noise (dBW)	-159
Desires Signal to Noise Patio (dB)	+1
Receiver Signal-to-Noise Ratio (dB)	depends on propagation mode
Maximum Path Length (km)	acpenas on propagation made

Typical 20 M Hand-Held Amateur Station

The typical SSB hand-held amateur station can communicate with other SSB voice amateur stations.

Characteristics	Values

14.15-14.35 Frequency Band (MHz) Random Channel Spacing speech Information Rate 2K50J3E Emission Type(s) Transmitter Power (dBW) Transmit: .0 Receive: 00 Transmission Line Loss (dB) Vertical Antenna Polarization -10 Antenna Maximum Gain (dBi) -7 Maximum e.i.r.p. (dBW) 2500 Hz Receiver IF Bandwidth Receiver Noise Figure (dB) 13 Receiver System Noise (dBW) -145 +6 Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km) Mizuho sell these little radios.

Typical 20 M AM station

Maximum Path Length (km)

Values Characteristics

14.15-14.3 Frequency Band (MHz) Random Channel Spacing Speech Information Rate 6K0A3E Emission Type(s) 31.7 Transmitter Power (dBW) Receive: 0.5 Transmit: .5 Transmission Line Loss (dB) Horizontal Antenna Polarization 12 Antenna Maximum Gain (dBi) 43.2 Maximum e.i.r.p. (dBW) Receiver IF Bandwidth 6 kHz Receiver Noise Figure (dB) -142 Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB) 10 Depends on propagation mode

Typical 6 M EME Amateur Station

The typical EME model is capable of CW communication with other EME stations.

Characteristics Values

Frequency Band (MHz) 50-54
Channel Spacing Random
Information Rate CW: 10 bit/s
Emission Type(s) 50H0A1A
Transmitter Power (dBW) 31.7
Transmission Line Loss (dB) Transmit: .2

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 19
Maximum e.i.r.p. (dBW) 50.5
Receiver IF Bandwidth CW: 50 Hz
Receiver Noise Figure (dB) 2

Receiver System Noise (dBW) -174 (5000 Kelvin background)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) 396,000 one way to moon at nominal apogee

Four big yagis and 1500 watts...

High End 6M SSB Amateur Station

The high-end SSB amateur station communicates with other SSB/CW stations using troposcatter.

Characteristics Values

Receive: 0.2

Frequency Band (MHz) 50-52
Channel Spacing Random
Information Rate Speech
Emission Type(s) 2K50J3E
Transmitter Power (dBW) 31.7

Transmitter Power (dBW)

Transmission Line Loss (dB)

Antenna Polarization

Transmit: 1

Receive: 0

Horizontal

Antenna Maximum Gain (dBi)

Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW)

44.4

Receiver IF Bandwidth SSB:2500 Hz CW:100 Hz

Receiver Noise Figure (dB)

Receiver System Noise (dBW) -160 (2645 Kelvin background)

Receiver Signal-to-Noise Ratio (dB) +6

Maximum Path Length (km) Depends on propagation mode

Single 50 ft boom yagi and 1500 watt amp.

Typical 6M SSB Amateur Station

The typical SSB amateur station communicates with other SSB/CW stations using troposcatter.

Characteristics Values

Frequency Band (MHz) 50-52
Channel Spacing Random
Information Rate Speech
Emission Type(s) 2K50J3E
Transmitter Power (dBW) 50-52

Transmission Line Loss (dB)

Transmit: 1

Receive: 1

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 12
Maximum e.i.r.p. (dBW) 37

Receiver IF Bandwidth SSB:2500 Hz CW:100Hz

Receiver Noise Figure (dB)

Receiver System Noise (dBW) -160 (195 Kelvin background) -174 (CW)

Receiver Signal-to-Noise Ratio (dB) +

Maximum Path Length (km) Depends on propagation mode

High-End 6M CW Amateur Station

The High-End CW amateur station communicates with other stations using troposcatter.

Characteristics

Values

Receive: 1

Frequency Band (MHz)	50-52
Channel Spacing	Random
Information Rate	10 bit/s
Emission Type(s)	100HA1A
Transmitter Power (dBW)	31.7

Transmission Line Loss (dB) Transmit: 1 Antenna Polarization Horizontal Antenna Maximum Gain (dBi) 13.7 Maximum e.i.r.p. (dBW) 44.4

Receiver IF Bandwidth CW:100Hz SSB:2500 Hz

Receiver Noise Figure (dB)

Receiver System Noise (dBW) -174 (2645 Kelvin background) -160 (SSB)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) Depends on propgation mode

Typical 6 M CW Amateur Station

The typical CW amateur station communicates with other stations using troposcatter.

Characteristics

Receive: 2

Frequency Band (MHz)	50-52
Channel Spacing	Random
Information Rate	10 bit/s
Emission Type(s)	100HA1A
Transmitter Power (dBW)	20
Transmission Line Loss (dB)	Transmit: 2
Antenna Polarization	Horizontal
Austrian - Marrison Cain (dDi)	10

Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW) 30 Receiver IF Bandwidth CW:100Hz SSB:2500 Hz

Receiver Noise Figure (dB)

-174 (2645 Kelvin background) -160 for SSB Receiver System Noise (dBW)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) Depends on the propagation mode

Typical 6 M FM mobile Amateur Station

The typical FM-mobile amateur station can communicate with other FM voice amateur stations. Characteristics **Values**

> 51-54 5-kHz steps

Frequency Band (MHz) Channel Spacing Information Rate

Speech 15K0F3E or 15K0G3E Emission Type(s) Transmitter Power (dBW)

Transmit: 1 Receive: 1 Transmission Line Loss (dB)

Vertical Antenna Polarization Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) 17 Receiver IF Bandwidth 15kHz Receiver Noise Figure (dB)

-152 (2645 Kelvin background) Receiver System Noise (dBW) +7 (for 12 dB SINAD) Receiver Signal-to-Noise Ratio (dB) Depends on propagation mode Maximum Path Length (km)

Typical 6 M FM-base Amateur Station

The typical FM voice station can communicate with other FM voice amateur stations. Characteristics Values

2

Receive: 2

Receive: 2

Frequency Band (MHz) 51-54 Channel Spacing 5 kHz steps Information Rate Speech

15K0F3E or 15K0G3E Emission Type(s) Transmitter Power (dBW) 20

Transmission Line Loss (dB) Transmit: 2 Antenna Polarization Vertical Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) 21 Receiver IF Bandwidth 15kHz

Receiver Noise Figure (dB) -152 (2645 Kelvin background) Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB) +7 (for 12 dB SINAD)

Maximum Path Length (km) Depends on propagation mode

Typical 6 M Repeater Amateur Station

The typical FM repeater station extends the range of mobile stations

Characteristics Values

Frequency Band (MHz) 51-54 Channel Spacing 20 kHz Information Rate Speech 15K0F3E or 15K0G3E Emission Type(s)

Transmitter Power (dBW) 18 Receive: 2

Transmit: 2 Transmission Line Loss (dB) Vertical Antenna Polarization Antenna Maximum Gain (dBi) 21

Maximum e.i.r.p. (dBW) Receiver IF Bandwidth 15kHz Receiver Noise Figure (dB) 2

Receiver System Noise (dBW) -152 (2645 Kelvin background) Receiver Signal-to-Noise Ratio (dB) +7 (for 12 dB SINAD) Maximum Path Length (km) Depends on propagation mode

Typical 6 M Digital Amateur Station

Packet stations are typically used for point to point links on this band.

Characteristics **Values**

50-54 Frequency Band (MHz) Channel Spacing 20 kHz

Information Rate 1.2, 4.8,9.6, 56 kbit/s 15K0F3D, 15K0G3D, 15K0G3D, 70K0G3D Emission Type(s) Transmitter Power (dBW)

Transmit: 2 Transmission Line Loss (dB) Horizontal Antenna Polarization 10 Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW) 15 kHz, 15 kHz, 15 kHz, 70 kHz Receiver IF Bandwidth

2 dB Receiver Noise Figure (dB) -152, -152, -145 (2645 Kelvin background)

Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) Depends on propagation mode

High End 6 M Beacon Amateur Station

Characteristics Values

Frequency Band (MHz) 50-50.1 **Channel Spacing** N/A Information Rate 10 bit/s Emission Type(s) 100HA1A Transmitter Power (dBW) 20 Transmission Line Loss (dB) Transmit:1 Antenna Polarization Horizontal Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) 22 Receiver IF Bandwidth 100 Hz Receiver Noise Figure (dB) 1 dB

Receiver System Noise (dBW) -174 (195 Kelvin background temperature)

Receiver Signal-to-Noise Ratio (dB) +1

Typical 6 M Beacon Amateur Station

High gain omnidirectional antennas are often used to maximize the possibility of detecting band openings in different directions.

Characteristics Values

Frequency Band (MHz) 50-50.1 Channel Spacing N/A Information Rate 10 bit/s Emission Type(s) 100HA1A Transmitter Power (dBW) 10 Transmission Line Loss (dB) Transmit:1 Antenna Polarization Horizontal Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) 12 Receiver IF Bandwidth 100 Hz Receiver Noise Figure (dB) 1 dB

Receiver System Noise (dBW) -174 (2645 Kelvin background temperature)

Receiver Signal-to-Noise Ratio (dB) +1

Maximum Path Length (km) depends on propagation mode

Typical 6 M Hand-Held Amateur Station

The typical FM hand-held amateur station can communicate with other FM voice amateur stations and repeaters using line-of-sight and diffraction propagation modes.

Characteristics Values

Frequency Band (MHz) 50-54
Channel Spacing 5 kHz
Information Rate Speech

Emission Type(s) 15k0F3E or 15K0G3E

Transmitter Power (dBW) 7
Transmission Line Loss (dB) Transmit:0
Antenna Polarization Vertical
Antenna Maximum Gain (dBi) 0
Maximum e.i.r.p. (dBW) 7

Maximum e.i.r.p. (dBW) 7
Receiver IF Bandwidth 15 kHz
Receiver Noise Figure (dB) 2 dB

Receiver System Noise (dBW) -152 (2645 Kelvin background temperature)

Receiver Signal-to-Noise Ratio (dB) +7 dB for 12 dB SINAD depends on propagation mode

Typical 6 M Radio Control Amateur Station

The typical 6M radio control station is used for remotely directing model craft. Characteristics

Frequency Band (MHz) Channel Spacing Information Rate Emission Type(s) Transmitter Power (dBW) Transmission Line Loss (dB) Antenna Polarization Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) Receiver IF Bandwidth Receiver Noise Figure (dB) Receiver System Noise (dBW) Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km)

50.8-51.0, 53.1-53.8 20 kHz, 100 kHz typically < 500 bps 15k0F8D or 15KA8D Transmit:0 Vertical -3 15 kHz 2 dB -152 (2645 Kelvin background temperature) +3

line of sight

Typical High-End 23-cm EME Station

Big 23 cm EME Amateur Station on CW--KB2AH running 1.4 kW and a 10.3 meter dish.

Characteristics

Values

Values

Receive: 0

Frequency Band (MHz) 1240-1300 Channel Spacing Random Information Rate CW: 10 bit/s Emission Type(s) 50H0A1A Transmitter Power (dBW) 31.5 Transmission Line Loss (dB) Transmit: 1 Receive: 0 Antenna Polarization Circular, RHCP Transmit, LHCP Receive Antenna Maximum Gain (dBi) 40.3 Maximum e.i.r.p. (dBW) Receiver IF Bandwidth CW: 50 Hz Receiver Noise Figure (dB) 0.3 Receiver Thermal Noise (dBW) -197 (10 Kelvin background) Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km) 396,000 one way to moon at nominal apogee

Big 23 cm EME Amateur Station on SSB

Channel Spacing

The big EME stations on this band can operate SSB.

Characteristics

1240-1300 Frequency Band (MHz) Random Speech

Information Rate 2K50J3E Emission Type(s) Transmitter Power (dBW) 31.5 Transmission Line Loss (dB) Transmit: 1

Circular, RHCP Transmit, LHCP Receive Antenna Polarization Antenna Maximum Gain (dBi) 40.3 Maximum e.i.r.p. (dBW) 71

Receiver IF Bandwidth SSB: 2500 Hz

Receiver Noise Figure (dB) 0.3

Receiver Thermal Noise (dBW) -180 (10 Kelvin background)

Receiver Signal-to-Noise Ratio (dB)

396,000 one way to moon at nominal apogee Maximum Path Length (km)

Typical 23 cm EME Amateur Station

The typical EME model is capable of CW communication with other EME stations. Characteristics . Values

1240-1300 Frequency Band (MHz) Random Channel Spacing CW: 10 bit/s Information Rate Emission Type(s) 50H0A1A

Transmitter Power (dBW) Transmission Line Loss (dB) Receive: 0 Circular, RHCP Transmit, LHCP Receive Antenna Polarization Antenna Maximum Gain (dBi) 32

54 Maximum e.i.r.p. (dBW) Receiver IF Bandwidth CW: 50 Hz Receiver Noise Figure (dB) 0.4

Receiver Thermal Noise (dBW) -195.8 (10 Kelvin background)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) 396,000 one way to moon at nominal apogee

High End 23 cm SSB Amateur Station

The high-end SSB amateur station communicates with other SSB/CW stations using troposcatter. Characteristics **Values**

Receive: 0

Frequency Band (MHz) 1240-1300 Channel Spacing Random Information Rate Speech Emission Type(s) 2K50J3E Transmitter Power (dBW) 23 Transmission Line Loss (dB) Transmit: 2

Antenna Polarization Horizontal Antenna Maximum Gain (dBi) 23 Maximum e.i.r.p. (dBW) 44

Receiver IF Bandwidth SSB:2500 Hz CW:100 Hz Receiver Noise Figure (dB) 0.4

Receiver Thermal Noise (dBW)

-172 (155 Kelvin background) Receiver Signal-to-Noise Ratio (dB) +6

Maximum Path Length (km) Depends on propagation mode

Typical 23 cm SSB Amateur Station

The typical SSB amateur station communicates with other SSB/CW stations using troposcatter. Characteristics

Frequency Band (MHz) 1240-1300 **Channel Spacing** Random Information Rate Speech Emission Type(s) 2K50J3E Transmitter Power (dBW) 12

Transmit: 0 Transmission Line Loss (dB) Receive: 0

Antenna Polarization Horizontal Antenna Maximum Gain (dBi) 20 Maximum e.i.r.p. (dBW) 32

SSB:2500 Hz CW:100Hz Receiver IF Bandwidth

Receiver Noise Figure (dB) 0.4

-172 (155 Kelvin background) -186 (CW) Receiver Thermal Noise (dBW)

Receiver Signal-to-Noise Ratio (dB) +6

Maximum Path Length (km) Depends on propagation mode

Note: Mast mounted transverter setup to eliminate the need for expensive feedlines.

Typically done with DEM and Parabolic AB equipment.

High-End 23 cm CW Amateur Station

The High-End CW amateur station communicates with other stations using troposcatter. Characteristics Values

Frequency Band (MHz) 1240-1300 Random Channel Spacing 10 bit/s Information Rate Emission Type(s) 100HA1A Transmitter Power (dBW) 23

Transmit: 2 Receive: 0 Transmission Line Loss (dB) Horizontal

Antenna Polarization Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW)

CW:100Hz SSB:2500 Hz Receiver IF Bandwidth

Receiver Noise Figure (dB)

Receiver Thermal Noise (dBW) -185 (155 Kelvin background) -171 (SSB)

23

44

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) Depends on propgation mode

Typical 23 cm CW Amateur Station

The typical CW amateur station communicates with other stations using troposcatter. Characteristics

Frequency Band (MHz) 1240-1300 Channel Spacing Random Information Rate 10 bit/s Emission Type(s) 100HA1A Transmitter Power (dBW) 10

Transmission Line Loss (dB) Transmit: 2 Antenna Polarization Horizontal

Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) 28

Receiver IF Bandwidth CW:100Hz SSB:2500 Hz Receiver Noise Figure (dB)

Receiver Thermal Noise (dBW)

-182 (155 Kelvin background) -168 for SSB +6

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) Depends on the propagation mode

Note: CW is often necessary on transmit to extend the range at this power level.

Typical 23 cm SSB Satellite Uplink Amateur Station

Due to international regulations, this band can only be used for uplinks to satellites; no satellites have downlinks on this band.

1

Characteristics

Values

Receive: 2

Frequency Band (MHz) 1260-1270 Channel Spacing Random Information Rate Speech Emission Type(s) 2K50J3E Transmitter Power (dBW) 15 Transmission Line Loss (dB) Transmit: 2 RHCP, Horizontal, or Vertical Antenna Polarization 23 Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW) 36 N/A Receiver IF Bandwidth Receiver Noise Figure (dB) N/A Receiver Thermal Noise (dBW) N/A Receiver Signal-to-Noise Ratio (dB) +6 45.000km Maximum Path Length (km)

Note: Mode L on Oscar 13 did not work as well as predicted--less power may be required with future satellites.

Typical 23 cm CW Satellite Uplink Amateur Station

Due to international regulations this band can only be used for satellite uplinks; no satellites have downlinks on this band.

Characteristics

Values

Frequency Band (MHz) 1260-1270 Random **Channel Spacing** 10 bit/s Information Rate 100HA1A Emission Type(s) Transmitter Power (dBW) 10 Transmit: 2 Transmission Line Loss (dB)

Antenna Polarization RHCP, Horizontal, or Vertical

Antenna Maximum Gain (dBi) 20 Maximum e.i.r.p. (dBW) 28 Receiver IF Bandwidth N/A Receiver Noise Figure (dB) N/A Receiver Thermal Noise (dBW) N/A Receiver Signal-to-Noise Ratio (dB) +6 45,000km Maximum Path Length (km)

Note: Mode L on Oscar 13 did not work as well as predicted--less power may be required with future satellites.

Typical 23 cm FM mobile Amateur Station

The typical FM-mobile amateur station can communicate with other FM voice amateur stations.

Characteristics Values

Receive: 1

Receive: 2

Frequency Band (MHz) 1240-1300

Channel Spacing Random, usually in 10-kHz steps

Information Rate Speech

Emission Type(s) 15K0F3E or 15K0G3E
Transmitter Power (dBW) 10

Transmission Line Loss (dB)

Antenna Polarization

Antenna Maximum Gain (dBi)

Transmit: 1

Vertical

8

Maximum e.i.r.p. (dBW) 17
Receiver IF Bandwidth 15kHz
Receiver Noise Figure (dB) 2

Receiver Noise Figure (dB)

Receiver Thermal Noise (dBW)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km)

-160 (155 Kelvin background)

+7 (for 12 dB SINAD)

Depends on propagation mode

Typical 23 cm FM-base Amateur Station

The typical FM voice station can communicate with other FM voice amateur stations.

Characteristics Valu

Frequency Band (MHz) 1240-1300

Channel Spacing Random, usually in 10-kHz steps

Information Rate Speech

Emission Type(s) 15K0F3E or 15K0G3E

Transmitter Power (dBW) 10
Transmission Line Loss (dB) Transmit: 2 Receive: 2
Antenna Polarization Vertical

Antenna Polarization Vertica
Antenna Maximum Gain (dBi) 20
Maximum e.i.r.p. (dBW) 28
Receiver IF Bandwidth 15kHz

Receiver IF Bandwidth
Receiver Noise Figure (dB)
Receiver Thermal Noise (dBW)
Receiver Signal-to-Noise Ratio (dB)
Maximum Path Length (km)

15kH2
2
-159 (155 Kelvin background)
+7 (for 12 dB SINDAD)
Depends on propagation mode

Typical 23 cm Repeater Amateur Station

The typical FM repeater station extends the range of mobile stations

Characteristics Values

Frequency Band (MHz) 1270-1276, 1282-1288
Channel Spacing 25 kHz in California
Information Rate Speech

Emission Type(s) 15K0F3E or 15K0G3E
Transmitter Power (dBW) 10

Transmission Line Loss (dB)

Antenna Polarization

Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW)

Receiver IF Bandwidth

Transmit: 2

Vertical

20

Maximum e.i.r.p. (dBW)

28

Receiver IF Bandwidth

15kHz

Receiver In Bandwidth

Receiver Noise Figure (dB)

Receiver Thermal Noise (dBW)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km)

15KH2

2

-159 (155 Kelvin background)

+7 (for 12 dB SINDAD)

Depends on propagation mode

Typical 23 cm AM ATV Amateur Station

The typical AM ATV station communicates with other ATV stations and repeaters using LOS modes.

Values

Receive: 0

Characteristics

Frequency Band (MHz) 1240-1300 Channel Spacing 6 MHz Information Rate Fast scan video

Emission Type(s) visual 5M25C3F Aural 36K0F3E 12

Transmitter Power (dBW)

Transmission Line Loss (dB) Transmit: 2 Antenna Polarization Horizontal Antenna Maximum Gain (dBi) Maximum e.i.r.p. (dBW) 30

Receiver IF Bandwidth 4.2 MHz Receiver Noise Figure (dB) 1 (mast mounted preamp) Receiver Thermal Noise (dBW) -139 (155 kelvin background) Receiver Signal-to-Noise Ratio (dB) 35 dB (4 dB for marginal contacts)

Maximum Path Length (km) line of sight

Typical 23 cm Packet Amateur Station

Packet stations are typically used for point to point links on this band.

Characteristics **Values**

Frequency Band (MHz) 1240-1300 Channel Spacing 25kHz, 100 kHz Information Rate 1.2, 9.6, 56 kit/s

15K0F3E, 15K0G3E, 70K0G3E Emission Type(s)

Transmitter Power (dBW)

Transmit: 2 Transmission Line Loss (dB) Receive: 2

Antenna Polarization Horizontal Antenna Maximum Gain (dBi) 20 Maximum e.i.r.p. (dBW) 15 kHz, 70 kHz Receiver IF Bandwidth

Receiver Noise Figure (dB) 2 dB

Receiver Thermal Noise (dBW) -162, -162, -155 Receiver Signal-to-Noise Ratio (dB) +7 (for 12 dB SINAD)

Maximum Path Length (km) line of sight

High End 23 cm Beacon Amateur Station

KH6HME--uses a high gain antenna to detect propagation over the tropo duct between Hawaii and North America.

Characteristics Values

1296.000 Frequency Band (MHz) **Channel Spacing** N/A Information Rate 10 bit/s Emission Type(s) 100HA1A Transmitter Power (dBW) 12 Transmission Line Loss (dB) Transmit:1 Antenna Polarization Horizontal Antenna Maximum Gain (dBi) 23 34 Maximum e.i.r.p. (dBW) Receiver IF Bandwidth 100 Hz

Receiver Noise Figure (dB) Receiver Thermal Noise (dBW) -185 (155 Kelvin background temperature)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) over 4100 km

Typical 23 cm Beacon Amateur Station

High gain omnidirectional antennas are often used to maximize the possibility of detecting band openings in different directions.

Characteristics

Values

Frequency Band (MHz)
Channel Spacing
Information Rate
Emission Type(s)
Transmitter Power (dBW)
Transmission Line Loss (dB)
Antenna Polarization
Antenna Maximum Gain (dBi)
Maximum e.i.r.p. (dBW)
Receiver IF Bandwidth
Receiver Noise Figure (dB)
Receiver Thermal Noise (dBW)
Receiver Signal-to-Noise Ratio (dB)
Maximum Path Length (km)

1296.-1297 N/A 10 bit/s 100HA1A 10 Transmit:1 Horizontal 9 18 100 Hz 1 dB

-185 (155 Kelvin background temperature)

+1

depends on propagation mode

Big 13 cm EME Amateur Station on CW--W4HHK

Characteristics

Values

Frequency Band (MHz) 2300-2310, 2390-2450 Channel Spacing Random Information Rate CW: 10 bit/s Emission Type(s) 50H0A1A Transmitter Power (dBW) 26

Transmission Line Loss (dB) Transmit: 3 Receive: 0

Antenna Polarization Linear; rotatable Antenna Maximum Gain (dBi) 44 Maximum e.i.r.p. (dBW) 67 CW: 50 Hz Receiver IF Bandwidth

Receiver Noise Figure (dB) 0.5

Receiver Thermal Noise (dBW) -194 (20 Kelvin background)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) 396,000 one way to moon at nominal apogee

Note: The VA802 Klystron used by W4HHK is capable of 1 kW of output power, but are typically run at 300 to 400 watts output. The noise from the moon doubles the background temperature.

Big 13 cm EME Amateur Station on SSB

The big EME stations on this band can operate SSB.

Characteristics

Values

Receive: 0

Receive: 0

Frequency Band (MHz) 2300-2310, 2390-2450 Random Channel Spacing Speech Information Rate 2K50J3E Emission Type(s) Transmitter Power (dBW) 26 Transmission Line Loss (dB) Transmit: 3 Linear; rotatable

Antenna Polarization 44

Antenna Maximum Gain (dBi) 67 Maximum e.i.r.p. (dBW)

Receiver IF Bandwidth SSB: 2500 Hz

Receiver Noise Figure (dB) 0.5

Receiver Thermal Noise (dBW) -177 (20 Kelvin background)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) 396,000 one way to moon at nominal apogee

Typical 13 cm EME Amateur Station

The typical EME model is capable of CW communication with other EME stations. Characteristics

2300-2310, 2390-2450 Frequency Band (MHz)

Channel Spacing Random CW: 10 bit/s Information Rate 50H0A1A Emission Type(s) Transmitter Power (dBW) 20 Transmit: 2 Transmission Line Loss (dB)

Linear; rotatable Antenna Polarization Antenna Maximum Gain (dBi) 37

55 Maximum e.i.r.p. (dBW) CW: 50 Hz Receiver IF Bandwidth 0.5 Receiver Noise Figure (dB)

-195 (10 Kelvin background) Receiver Thermal Noise (dBW)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) 396,000 one way to moon at nominal apogee

High End 13 cm SSB Amateur Station

The high-end SSB amateur station communicates with other SSB/CW stations using troposcatter.

Characteristics Values

Frequency Band (MHz)
Channel Spacing
Information Rate
Emission Type(s)
Transmitter Power (dBW)
S2300-2310
Random
Speech
Extra Speech
2K50J3E
26

Transmission Line Loss (dB)

Antenna Polarization

Antenna Maximum Gain (dBi)

Transmit: 3

Horizontal
26

Maximum e.i.r.p. (dBW) 26

Receiver IF Bandwidth SSB:2500 Hz CW:100 Hz

Receiver Noise Figure (dB) 0.5

Receiver Thermal Noise (dBW) -172 (155 Kelvin background) -186 (CW)

Receiver Signal-to-Noise Ratio (dB) +6

Maximum Path Length (km) Depends on propagation mode

Typically 200 watts and a dish with his VA-802 Klystron factoring in feed line loss.

Typical 13 cm SSB Amateur Station

The typical SSB amateur station communicates with other SSB/CW stations using troposcatter.

Characteristics Values

Frequency Band (MHz)

Channel Spacing

Information Rate

Emission Type(s)

Transmitter Power (dBW)

Transmission Line Loss (dB)

2300-2310

Random

Speech

2K50J3E

10

Transmit: 3

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 23

Antenna Maximum Gain (dBi) 23 Maximum e.i.r.p. (dBW) 30

Receiver IF Bandwidth SSB:2500 Hz CW:100Hz

Receiver Noise Figure (dB) 0.5

Receiver Thermal Noise (dBW) -172 (155 Kelvin background) -186 (CW)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km) Depends on propagation mode

High-End 13 cm CW Amateur Station

The High-End CW amateur station communicates with other stations using troposcatter.

Characteristics

Values

Receive: 0

Receive: 0

Receive: 0

Frequency Band (MHz)
Channel Spacing
Information Rate
Emission Type(s)
Transmitter Power (dBW)

2300-2310
Random
10 bit/s
100HA1A
23

Transmission Line Loss (dB)

Antenna Polarization

Antenna Polarization

Antenna Polarization

Antenna Polarization

Antenna Polarization

Antenna Maximum Gain (dBi)
Antenna Maximum Gain (dBi)
Maximum e.i.r.p. (dBW)
50

Receiver IF Bandwidth CW:100Hz SSB:2500 Hz

Receiver Noise Figure (dB)

Receiver Thermal Noise (dBW) -186 (155 Kelvin background) -172 (SSB)

Receiver Signal-to-Noise Ratio (dB) +

Maximum Path Length (km) Depends on propgation mode

Typical 13cm CW Amateur Station

The typical CW amateur station communicates with other stations using troposcatter.

Characteristics Values

Frequency Band (MHz)
Channel Spacing
Information Rate
Emission Type(s)
Transmitter Power (dBW)

2300-2310
Random
10 bit/s
10 bit/s
100HA1A

Transmission Line Loss (dB)

Transmit: 3

Receive: 3

Antenna Polarization Horizontal
Antenna Maximum Gain (dBi) 20
Maximum e.i.r.p. (dBW) 20

Receiver IF Bandwidth CW:100Hz SSB:2500 Hz

Receiver Noise Figure (dB)

Receiver Thermal Noise (dBW) -181 (155 Kelvin background) -167 for SSB

Receiver Signal-to-Noise Ratio (dB) +

Maximum Path Length (km) Depends on the propagation mode

Note: CW is often necessary on transmit to extend the range at this power level.

Typical 13 cm SSB Satellite Amateur Station

Characteristics Values

 Frequency Band (MHz)
 2400-2450

 Channel Spacing
 Random

 Information Rate
 Speech

 Emission Type(s)
 2K50J3E

 Transmitter Power (dBW)
 10

Transmission Line Loss (dB)

Transmit: 0 Receive: 0

Antenna Polarization RHCP
Antenna Maximum Gain (dBi) 20
Maximum e.i.r.p. (dBW) 30
Receiver IF Bandwidth 2500 Hz
Receiver Noise Figure (dB) .4

Receiver Thermal Noise (dBW) -178 (20 Kelvin background)

Receiver Signal-to-Noise Ratio (dB) +6
Maximum Path Length (km) +5,000km

Note: projections based on available hardware pending launch of the amateur Phase 3D

satellite.

Typical 13 cm CW Satellite Amateur Station

I y picar 10 cm	C *	
	Characteristics	Values

Frequency Band (MHz) 2400-2450
Channel Spacing Random
Information Rate 10 bit/s
Emission Type(s) 100HA1A

Transmitter Power (dBW)

Transmission Line Loss (dB)

Antenna Polarization

3

Transmit: 0 Receive: 0

RHCP, Horizontal, or Vertical

 Antenna Maximum Gain (dBi)
 20

 Maximum e.i.r.p. (dBW)
 23

 Receiver IF Bandwidth
 100 Hz

 Receiver Noise Figure (dB)
 .4

 Receiver Thermal Noise (dBW)
 -192

 Receiver Signal-to-Noise Ratio (dB)
 +1

 Maximum Path Length (km)
 45,000km

Typical 13 cm FM mobile Amateur Station

The typical FM-mobile amateur station can communicate with other FM voice amateur stations.

Characteristics Values

2400-2450, 2300-2310 Frequency Band (MHz) Channel Spacing Random, usually in 5-kHz steps Information Rate Speech 15K0F3E or 15K0G3E Emission Type(s) Transmitter Power (dBW) Transmission Line Loss (dB) Transmit: 2 Receive: 2 Antenna Polarization Vertical Antenna Maximum Gain (dBi) R Maximum e.i.r.p. (dBW) 9 Receiver IF Bandwidth 15kHz Receiver Noise Figure (dB) 2 -159 (155 Kelvin background) Receiver Thermal Noise (dBW) +7 (for 12 dB SINAD) Receiver Signal-to-Noise Ratio (dB) Depends on propagation mode Maximum Path Length (km)

Typical 13 cm FM-base Amateur Station

The typical FM voice station can communicate with other FM voice amateur stations.

Characteristics Values

2400-2450, 2300-2310 Frequency Band (MHz) Random, usually in 5-kHz steps **Channel Spacing** Speech Information Rate 15K0F3E or 15K0G3E Emission Type(s) Transmitter Power (dBW) Transmit: 2 Receive: 2 Transmission Line Loss (dB) Vertical Antenna Polarization Antenna Maximum Gain (dBi) 20 Maximum e.i.r.p. (dBW) 21 Receiver IF Bandwidth 15kHz Receiver Noise Figure (dB) 2 -159 (155 Kelvin background) Receiver Thermal Noise (dBW) +7 (for 12 dB SINDAD) Receiver Signal-to-Noise Ratio (dB) Maximum Path Length (km) Depends on propagation mode

Typical 13 cm Repeater Amateur Station

The typical FM repeater station extends the range of mobile stations
Characteristics Values

Frequency Band (MHz)

Channel Spacing

Information Rate

Emission Type(s)

Transmitter Power (dBW)

Transmission Line Loss (dB)

Antenna Polarization

2306-2309, 2410-2413

25 kHz in California

Speech

15K0F3E or 15K0G3E

8

Transmit: 2

Vertical

Antenna Maximum Gain (dBi)

Maximum e.i.r.p. (dBW)

Receiver IF Bandwidth

Receiver Noise Figure (dB)

Receiver Thermal Noise (dBW)

Receiver Signal-to-Noise Ratio (dB)

Maximum Path Length (km)

12

28

15kHz

2

-159 (155 Kelvin background)

+7 (for 12 dB SINDAD)

Depends on propagation mode

Receive: 2